

TRADE NAME	Motorola	MODELS	CHASSIS	TUNERS
		21K30, 21K30B, 21K30W, 21T22, 21T22B	TS-531	TT-72 (VHF only)
		Y21K30, Y21K30B, Y21K30W, Y21T22, Y21T22B	TS-531Y	TT-72Y & TT-37 (VHF-UHF)
		21K29, 21K29B, 21K29W, 21K33E, 21T21, 21T21B, 21T21E	WTS-531	TT-72 (VHF only)
		Y21K29, Y21K29B, Y21K29W, Y21K33E, Y21T21, Y21T21B, Y21T21E	WTS-531Y	TT-72Y & TT-37 (VHF-UHF)
MANUFACTURER	Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Illinois			
TYPE SET	Television Receiver			
TUBES	Seventeen			
POWER SUPPLY	110-120 Volts AC-60 Cycle			
TUNING RANGE	Channels 2 thru 13 VHF, 14 thru 83 UHF, Video IF 45.75MC, Sound IF 41.25MC (Inter-carrier)			

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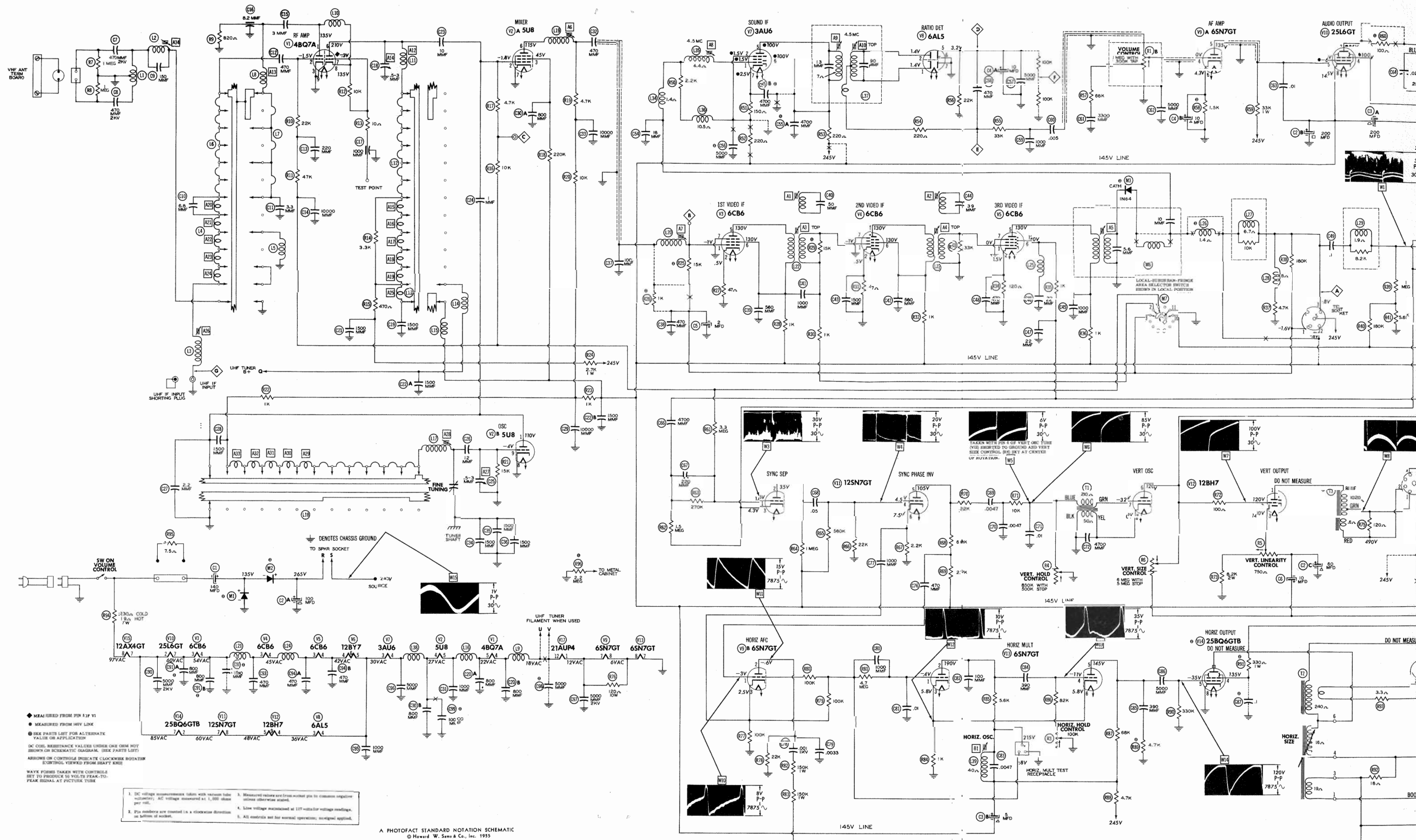
HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

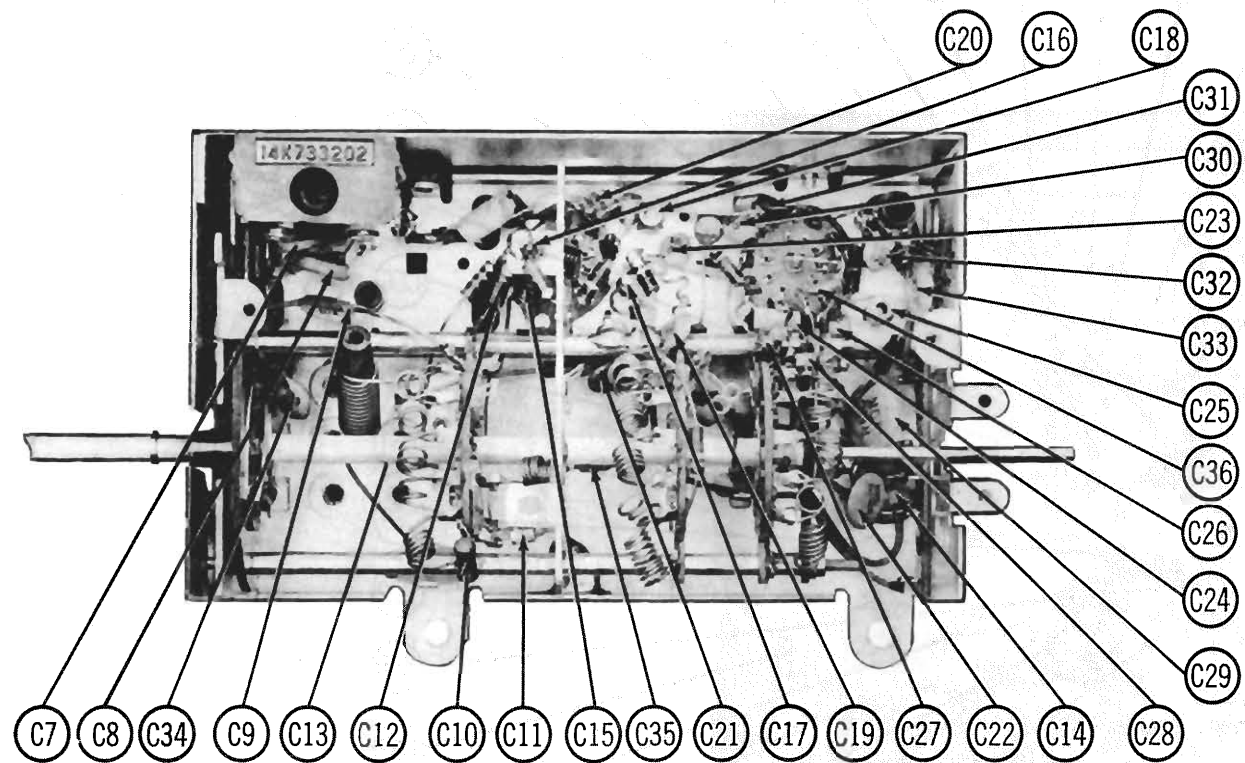
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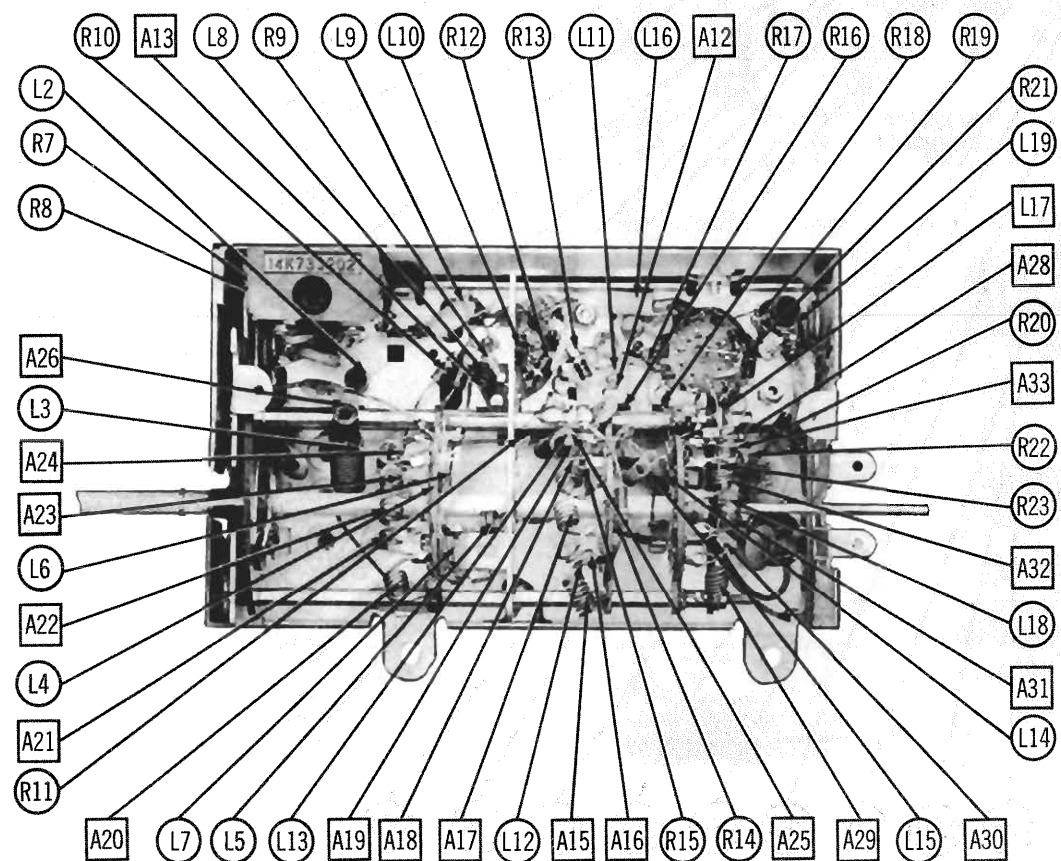
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MOTOROLA MODELS 21K29, B, W, Y21K29, B, W, 21K30, B, Y21K30, B, 21T21, B, E, Y21T21, B, E, 21T22, B, Y21T22, B (Ch. TS-531, Y, WTS-531, Y)

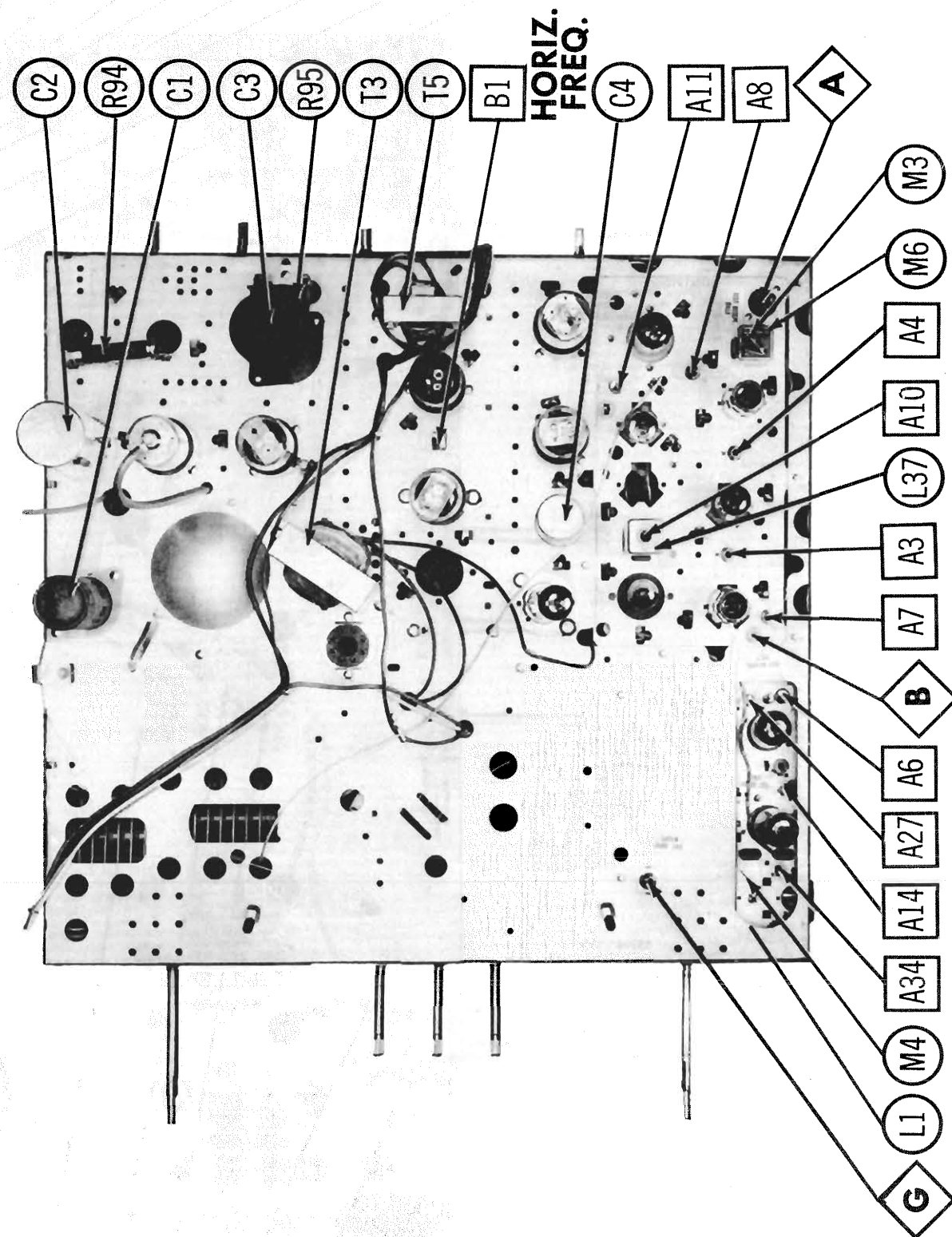




RF TUNER-BOTTOM VIEW

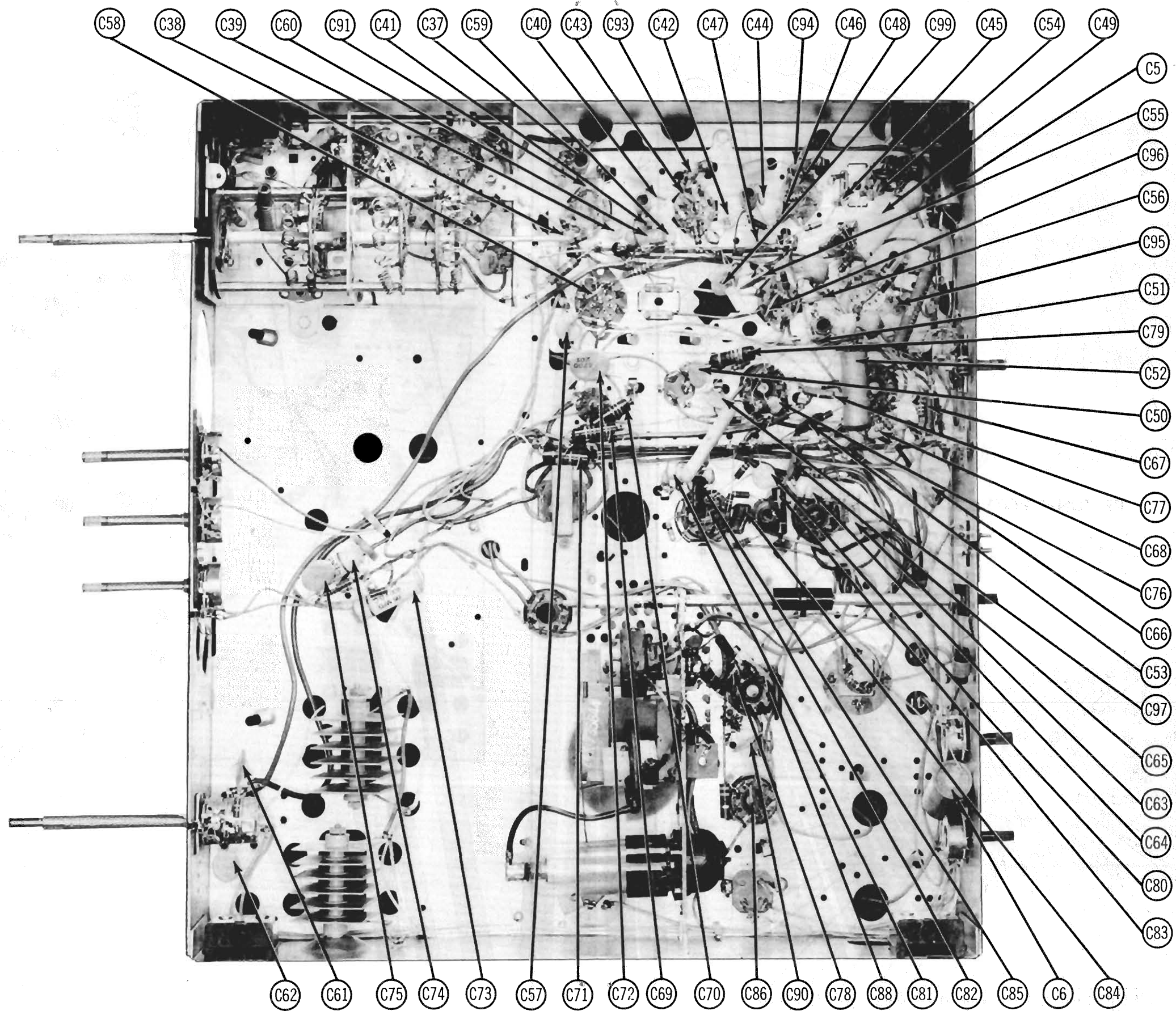


RF TUNER-BOTTOM VIEW



MAIN TOP VIEW

MOTOROLA MODELS 21K29, B, W, Y21K29, B, W, 21K30, B, Y21K30, B, 21T21, B, E, Y21T21, B, E, 21T22, B, Y21T22, B (Ch. TS-531, Y, WTS-531, Y)



CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

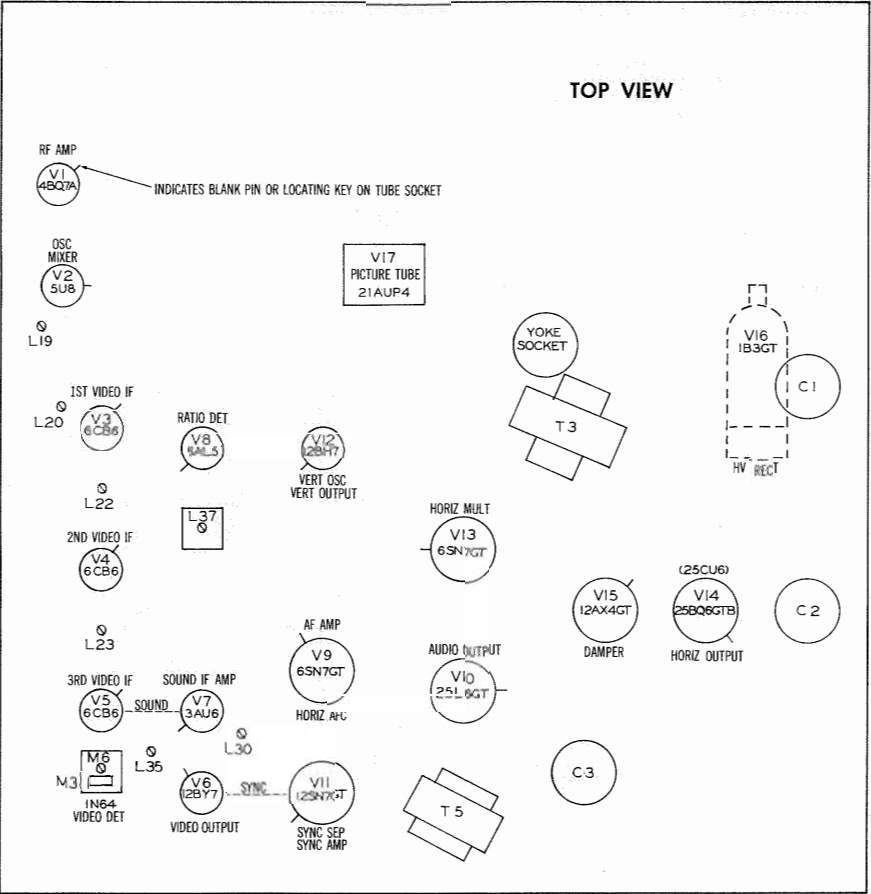
MOTOROLA MODELS 21K29, B, W, Y21K29, B, W, 21K30, B,
Y21K30, B, 21T21, B, E, Y21T21, B, E, 21T22, B, Y21T22, B
(Ch. TS-531, Y, WTS-531, Y)

RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	4BQ7A	Inf.	250KΩ	0Ω	5Ω	6Ω	†3.4KΩ	Inf.	Inf.	0Ω
V 2	5U8	■2KΩ	180KΩ	■220KΩ	7Ω	6Ω	■16KΩ	0Ω	0Ω	15KΩ
V 3	6CB6	180KΩ	47Ω	20Ω	18Ω	■1KΩ	■1KΩ	0Ω		
V 4	6CB6	180KΩ	47Ω	18Ω	18Ω	■1KΩ	■1KΩ	0Ω		
V 5	6CB6	. 1Ω	120Ω	18Ω	14Ω	■1KΩ	†17KΩ	0Ω		
V 6	12B47	170Ω	1Meg	170Ω	14Ω	8Ω	11Ω	†4KΩ	†22KΩ	170Ω
V 7	3AU6	■2.2KΩ	■220Ω	8Ω	7Ω	†300Ω	†300Ω	■370Ω		
V 8	6AL5	Inf.	Inf.	12Ω	8Ω	22KΩ	0Ω	0Ω		
V 9	6SN7GT	300KΩ	22KΩ	100KΩ	350KΩ	†33KΩ	1.5KΩ	3Ω	2Ω	
V 10	25L6GT	TP	22Ω	†400Ω	†90Ω	200KΩ	TP	20Ω	200KΩ	
V 11	12SN7GT	1.2Meg	■1Meg	170Ω	22KΩ	■9.5KΩ	2.2KΩ	22Ω	18Ω	
V 12	12BH7	■1KΩ	■3Meg	9KΩ	12Ω	18Ω	■3Meg	650KΩ	50Ω	16Ω
V 13	6SN7GT	5Meg	†10KΩ	1KΩ	150KΩ	†70KΩ	1KΩ	0Ω	2Ω	
V 14	25BQ6GTB	TP	21Ω	TP	†330Ω	330KΩ	NC	22Ω	0Ω	TOP CAP ■34Ω
V 15	12AX4GT	TP	NC	Inf.	TP	†90Ω	TP	22Ω	25Ω	
V 16	1B3GT		PINS	1-8	HAVE	INF	RESISTANCE			TOP CAP ■275Ω
V 17	21AUP4	3Ω	†2.7Meg	PIN 6 ■16Ω	PIN 10 ■16Ω	PIN 11 †130KΩ	PIN 12 5Ω			

†MEASURED FROM OUTPUT OF M2.
■MEASURED FROM 145V LINE.
▲MEASURED FROM PIN 3 OF V15.
NC-NO CONNECTION.
TP-TIE POINT.

TUBE PLACEMENT CHART



TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

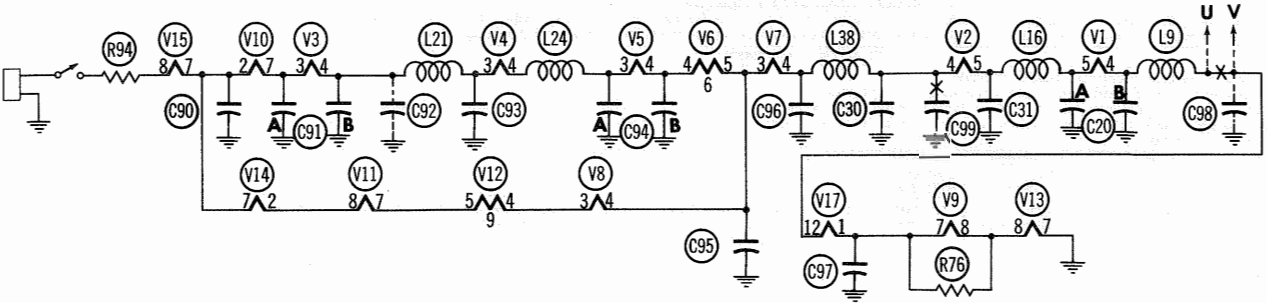
POWER SUPPLY FAILURE
No raster, no sound - Selenium Rectifiers (M1 & M2)

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V2, V3, V4, V5, V10
No pic, no sound, has snow - V1, V2, V3
No pic, has sound, has raster - V6, V7
Has pic, no sound - V7, V8, V9, V10

SYNC FAILURE
No vert, sync - V11, V12
No horiz, sync - V9, V11, V13
No vert, or horiz, sync - V11

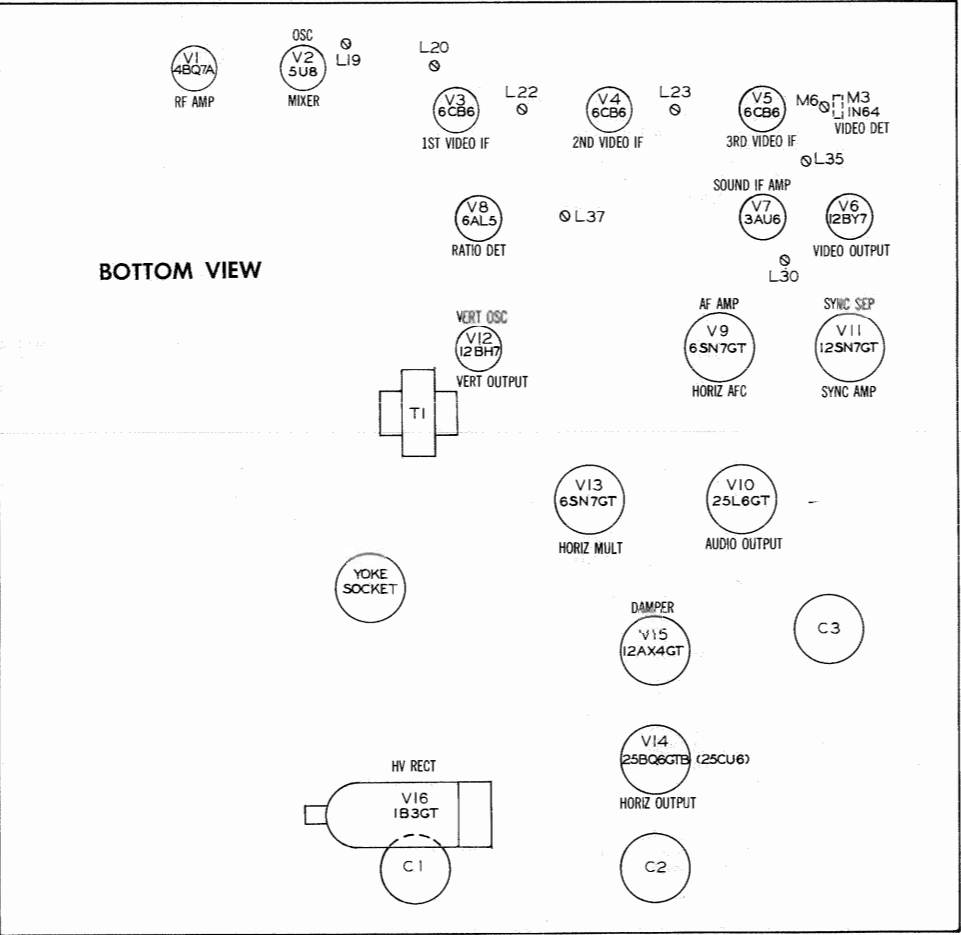
SWEEP FAILURE
No raster, has sound - V13, V14, V15, V16, V17
No vertical deflection - V12
Poor vert. linearity or foldover - V12
Poor horiz. linearity or foldover - V13, V14, V15
Narrow picture - V13, V14, V15, V16, M1, M2
Vert. off freq. - V11, V12
Horiz. off freq. - V9, V11, V13

NOTE: Since this receiver employs tubes used in series-parallel filament network, an open filament in any tube in series may cause the set to be inoperative. (See circuit below).



MOTOROLA MODELS 21K29, B, W, Y21K29, B, W,
21K30, B, Y21K30, B, 21T21, B, E, Y21T21, B, E,
21T22, B, Y21T22, B (Ch. TS-531, Y, WTS-531, Y)




TUBE PLACEMENT CHART



ALIGNMENT INSTRUCTIONS

RF AND MIXER ALIGNMENT (CONT.)


RF AND MIXER ALIGNMENT (CONT.)

DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead. Use very short leads.	177MC (10MC Swp)	175.25MC 179.75MC	7	Vert. Amp. thru 47KΩ to point  . Low side to chassis.	A14	Adjust for response similar to Fig. 6. Be sure all markers fall within limits shown. Recheck channel 13. If necessary, retouch A12 adjustment SLIGHTLY.
"	"	207MC (10MC Swp)	205.25MC 209.75MC	12	"		Check for response curve similar to Fig. 6 on each channel. (If response is checked with tuner shield cover in place the video marker will move up the curve a short distance, but markers should be within limits.)
		201MC (10MC Swp)	199.75MC 203.75MC	11			
		195MC (10MC Swp)	193.25MC 197.75MC	10			
		189MC (10MC Swp)	187.25MC 191.75MC	9			
		183MC (10MC Swp)	181.25MC 185.75MC	8			
"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A15, A20	Adjust A15 by compressing or expanding coil turns to obtain response similar to Fig. 7 with markers not falling below 60%. Usually the antenna coils A20 thru A24 are not to be adjusted. If the antenna coils have been distorted, they may be adjusted by compressing or expanding coil turns for maximum response in conjunction with the RF coils (A15 thru A19).
"	"	79MC (10MC Swp)	77.25MC 81.75MC	5	"	A16, A21	Adjust A16 by compressing or expanding coil turns for response similar to Fig. 7. For A21 see remarks step 12.
"	"	69MC (10MC Swp)	67.25MC 71.75MC	4	"	A17, A22	Adjust A17 for response similar to Fig. 7. For A22 see remarks step 12.
"	"	63MC (10MC Swp)	61.25MC 65.75MC	3	"	A18, A23	Adjust A18 for response similar to Fig. 7. For A23 see remarks step 12.
"	"	57MC (10MC Swp)	55.25MC 59.75MC	2	"	A19, A24	Adjust A19 for response similar to Fig. 7. For A24 see remarks step 12. Replace tuner shield and recheck channels 13 thru 2. Response on channels 6 thru 2 must be similar to Fig. 7 with marker not falling below 60% on response curve.
7. Direct	High side to point  . Low side to chassis.	44MC (10MC Swp)	42.25MC 45.75MC	UHF	"	A25, A26	Remove tuner shield. Remove UHF shorting plug at point  . Preset A26 slug maximum clockwise. Adjust A25 and A26 for response similar to Fig. 7. A25 is adjusted by expanding or compressing coil turns. Replace UHF shorting plug.


OSCILLATOR ALIGNMENT

Remove shorting jumper from pin 9 to V2B and chassis. Replace the 3 volt bias supply as under "Video IF Alignment". Use only enough sweep generator output from generator to produce useable pattern on scope. Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection. The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω. Set the fine tuning control to the mid-position of its range.

OSCILLATOR ALIGNMENT


DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	195MC (10MC Swp)	193.25MC 197.75MC	10	Vert. Amp. thru 47KΩ to point  . Low side to chassis.	A27	Adjust to place sound marker SLIGHTLY higher than the sound trap notch. This allowance must be made due to the removal of tuner shield. With shield replaced, the sound marker should move down into the trap notch. Check channels 7 thru 13 noting if sound marker for each channel falls just above the trap notch. Response should be similar to Fig. 8. If more than a 30 degree rotation of fine tuning control is necessary to place sound marker in proper position on any high band adjust A28. If A28 is adjusted it may be necessary to readjust A27 on channel 10.
		203MC (10MC Swp)	201.25MC 205.75MC	13			
		207MC (10MC Swp)	205.25MC 209.75MC	12			
		201MC (10MC Swp)	199.25MC 203.75MC	11			
		189MC (10MC Swp)	187.25MC 191.75MC	9			
		183MC (10MC Swp)	181.25MC 185.75MC	8			
		177MC (10MC Swp)	175.25MC 179.75MC	7			
"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A29	Check to see that fine tuning is at its mid-range capacity. Adjust A29 by compressing or expanding coil to place sound marker just above trap notch (Fig. 8)
"	"	79MC (10MC Swp)	77.25MC 81.75MC	5	"	A30	Adjust by compressing or expanding coil to place sound marker just above trap notch (Fig. 8) with fine tuning set within 15 degrees of mid-position.
		69MC (10MC Swp)	67.25MC 71.75MC	4		A31	
		63MC (10MC Swp)	61.25MC 65.75MC	3		A32	
		57MC (10MC Swp)	55.25MC 59.75MC	2		A33	

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DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
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		189MC (10MC Swp)	187.25MC 191.75MC	9			
		183MC (10MC Swp)	181.25MC 185.75MC	8			
		177MC (10MC Swp)	175.25MC 179.75MC	7			
"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A29	Check to see that fine tuning is at its mid-range capacity. Adjust A29 by compressing or expanding coil to place sound marker just above trap notch (Fig. 8)
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		203MC (10MC Swp)	201.25MC 205.75MC	13			
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		177MC (10MC Swp)	175.25MC 179.75MC	7			
"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A29	Check to see that fine tuning is at its mid-range capacity. Adjust A29 by compressing or expanding coil to place sound marker just above trap notch (Fig. 8)
"	"	79MC (10MC Swp)	77.25MC 81.75MC	5	"	A30	Adjust by compressing or expanding coil to place sound marker just above trap notch (Fig. 8) with fine tuning set within 15 degrees of mid-position.
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		203MC (10MC Swp)	201.25MC 205.75MC	13			
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		63MC (10MC Swp)	61.25MC 65.75MC	3		A32	
		57MC (10MC Swp)	55.25MC 59.75MC	2		A33	

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SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

For touch-up adjustment of VHF tuner oscillator adjustments, it is necessary to remove the chassis from the cabinet. (See disassembly instructions).

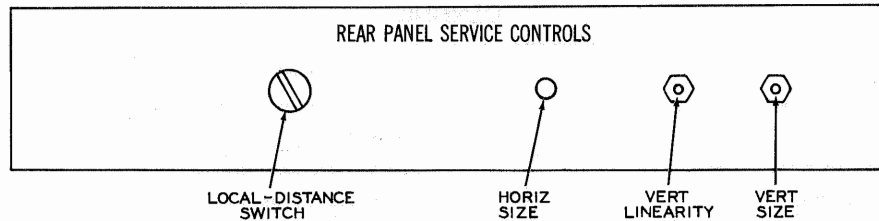
PICTURE TUBE SAFETY GLASS CLEANING

To clean safety glass, remove 4 metal screws holding metal strip at the top of the safety glass. Remove metal strip and safety glass. Use extreme caution when removing safety glass.

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION



HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

To adjust the horizontal oscillator, it is necessary to remove the rear cover and supply power to set. Adjustment is located on top of chassis. Set the horizontal hold control at the center of its range and adjust the horizontal oscillator coil (L39) slug until picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, adjust the ratio detector secondary (L37) located on top of chassis. (See tube placement chart).

CENTERING

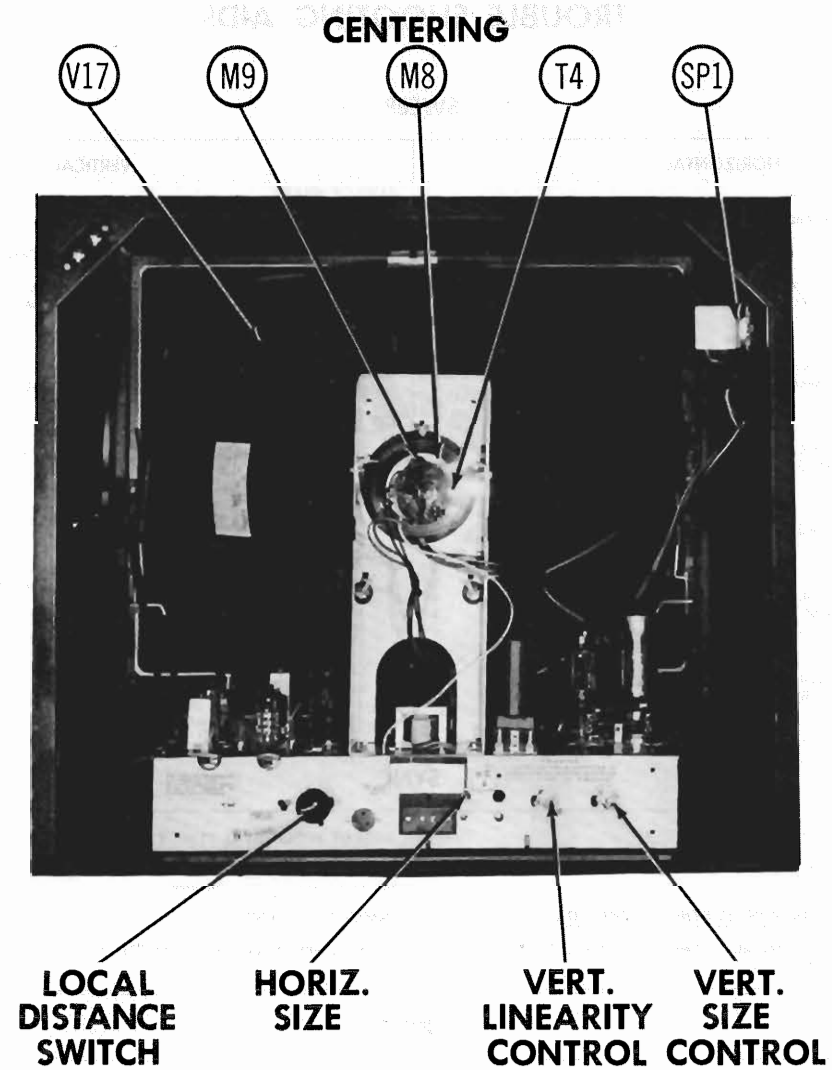
Centering is accomplished mechanically by adjusting two magnetic rings around the neck of the picture tube, located flush against the deflection yoke. Rotate the two rings around the neck of the tube until the picture is properly centered.

DISASSEMBLY INSTRUCTIONS

CHASSIS REMOVAL

1. Remove 7 push-on type control knobs from front panel of cabinet.
2. Remove 1 metal screw. Remove rear cover by unclipping.
3. Remove 2 metal screws. Remove antenna bracket.
4. Remove clip-on resistor fastened to cabinet.
5. Disconnect speaker plug.
6. Remove 4 chassis bolts. Remove chassis.
7. Remove 4 speaker nuts. Remove speaker.

NOTE: If it is necessary to remove the chassis for servicing, it is also necessary to remove the speaker. The speaker is the electro-magnetic type and must be connected for proper operation.



CABINET-REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern.

Normally the horizontal hold control will have a sync range of approximately 50 degrees. If the control is too critical, adjust as follows:

1. Set the area selector switch to "Local" position and all other controls for a normal picture.
2. Short out the AFC voltage. Shunt the horizontal oscillator coil (L39) to ground with a .1MFD 400V capacitor. This may be done with the chassis in cabinet by using the three pin socket on rear of chassis labeled "Test Receptable only".
3. Adjust the horizontal hold control to the point where picture remains stable horizontally.
4. Remove the .1MFD capacitor from L39 and adjust the horizontal oscillator slug (B1) to the point where picture remains stable horizontally.
5. Remove short from AFC voltage and adjust the horizontal hold control until picture remains in sync over approximately 30 degrees of its range while switching off channel and back again.

Adjust the horizontal size control for a picture slightly wider than necessary to fill the picture mask horizontally.

MOTOROLA MODELS 21K29, B, W, Y21K29, B, W, 21K30, B, Y21K30, B, 21T21, B, E, Y21T21, B, E, 21T22, B, Y21T22, B (Ch. 15-531, Y, WTS-531, Y)

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL	VERTICAL				
<p><u>LOSS OF SWEEP</u></p> <p>Follow procedure outlined under "Loss of High Voltage."</p>	<p><u>LOSS OF SWEEP</u></p> <p>Substitute V12. Check waveform W7.</p>				
<p><u>INSUFFICIENT SWEEP</u></p> <p>Check by substitution V10, V14 and V15. Check M1 and M2. Check C85, C86, R89, R91, T2, T4A and other associated components.</p>	<table border="1"> <tr> <th data-bbox="699 374 997 391">If Satisfactory</th><th data-bbox="997 374 1162 391">If Unsatisfactory</th></tr> <tr> <td data-bbox="699 391 997 409">Check T3, T4B, R73, R5 and other associated components.</td><td data-bbox="997 391 1162 409">Check T1, C6, C72, R6 and other associated components.</td></tr> </table>	If Satisfactory	If Unsatisfactory	Check T3, T4B, R73, R5 and other associated components.	Check T1, C6, C72, R6 and other associated components.
If Satisfactory	If Unsatisfactory				
Check T3, T4B, R73, R5 and other associated components.	Check T1, C6, C72, R6 and other associated components.				
<p><u>DRIVE LINES</u></p> <p>Check by substitution V10, V14 and V15. Check T2, T4A, C85, C86, R91 and other associated components.</p>	<p><u>INSUFFICIENT SWEEP</u></p> <p>Substitute V12. Check vertical size and vertical linearity controls for proper operation and other associated components.</p>				
<p><u>COMPRESSED LEFT SIDE</u></p> <p>Check by substitution V10, V14 and V15. Check horizontal output and damper stages for component failure or change of value.</p>	<p><u>COMPRESSED AT BOTTOM</u></p> <p>Substitute V12. Check R6, C6, C72, T1 and other associated components.</p>				
<p><u>FOLDS</u></p> <p>Follow procedure outlined under "Drive Lines."</p>	<p><u>COMPRESSED AT TOP</u></p> <p>Substitute V12. Check T3, C2C, R73, R5 and other associated components.</p>				
<p><u>PIE CRUST EFFECT</u></p> <p>Check by substitution V13, V14 and V15. Check C81 for open. Check L39, C80, R81 and other associated components.</p>	<p><u>FOLDS</u></p> <p>Substitute V12. Check C73, C74, T3, T4B and other associated components.</p>				
<p><u>XMAS TREE EFFECT</u></p> <p>Check by substitution V13, V14 and V15. Check T2 and T4 for internal arcing. Check L39, C78, C79, C83, C84, R78, R85 and other associated components.</p>					

SYNC

<p><u>LOSS OF VERTICAL AND HORIZONTAL SYNC</u></p> <p>Substitute V11. Check C66, C67, C68, R64, R68, R69 and other associated components.</p>	<p><u>LOSS OF HORIZONTAL SYNC-VERTICAL SYNC SATISFACTORY</u></p> <p>Check by substitution V9 and V13. Check C76, C77, C80, C81, R81, L39 and other associated components.</p>
<p><u>LOSS OF VERTICAL SYNC-HORIZONTAL SYNC SATISFACTORY</u></p> <p>Substitute V12. Check vertical integrator network. Check R4, T1, C72 and other associated components.</p>	<p><u>HORIZONTAL BENDING</u></p> <p>Check by substitution V9, V11 and V13. Check horizontal AFC network.</p>

VIDEO

<p><u>LOSS OF VIDEO</u></p> <p>Substitute V6. Check C49, C50, C52, L32, R43, R44 and other associated components.</p> <p><u>SOUND BARS(4.5MC BEAT)</u></p> <p>Adjust tuner fine tuning for best sound and picture. Check adjustment A-II. Check video IF alignment.</p> <p><u>POOR CONTRAST</u></p> <p>Substitute V6. Check contrast control. Check video crystal detector network. Check L31, L33, R46, C49, C52 and other associated components.</p>	<p><u>NEGATIVE PICTURE</u></p> <p>Substitute V6. Check picture tube. Check C49, C52, R46, R44 and other associated components.</p> <p><u>SMEAR</u></p> <p>Substitute V6. Check L26, L27, L28, L29, L31, L33, C49, C52 and other associated components.</p> <p><u>WIDE BLACK BAR ACROSS PICTURE</u></p> <p>Check by substitution V1, V3, V4, V5 and V6 for heater to cathode leakage.</p>
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AUDIO

<u>WEAK OR NO SOUND</u>		<u>BUZZ</u>
Check by: substitution V7, V8, V9 and V10. Check stages V9 and V10 using audio signal generator. Apply audio signal across R1B.		Adjust tuner fine tuning for best sound and picture. Check adjustment A10 for minimum buzz. If still unsatisfactory, check audio IF alignment.
If Satisfactory	If Unsatisfactory	<u>DISTORTED</u>
Check ratio detector and audio IF stages for component failure or change of value.	Check C60, C63, C64, C4B, R59, T5, speaker and other associated components.	Follow procedure outlined under "Weak or no Sound."

POWER

<p><u>DEAD SET</u></p> <p>If filaments fail to light, check all tubes. These tubes are connected in series. Check AC interlock assembly. Check switch on volume control and R94. If filaments light, check M1, M2, C1 and R95. Check B+ filter and decoupling network.</p>	<p><u>SMALL AND/OR DIM PICTURE</u></p> <p>Check M1, M2, R95 and C1. Check B+ filter and decoupling network.</p>
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TROUBLE SHOOTING AIDS (cont)

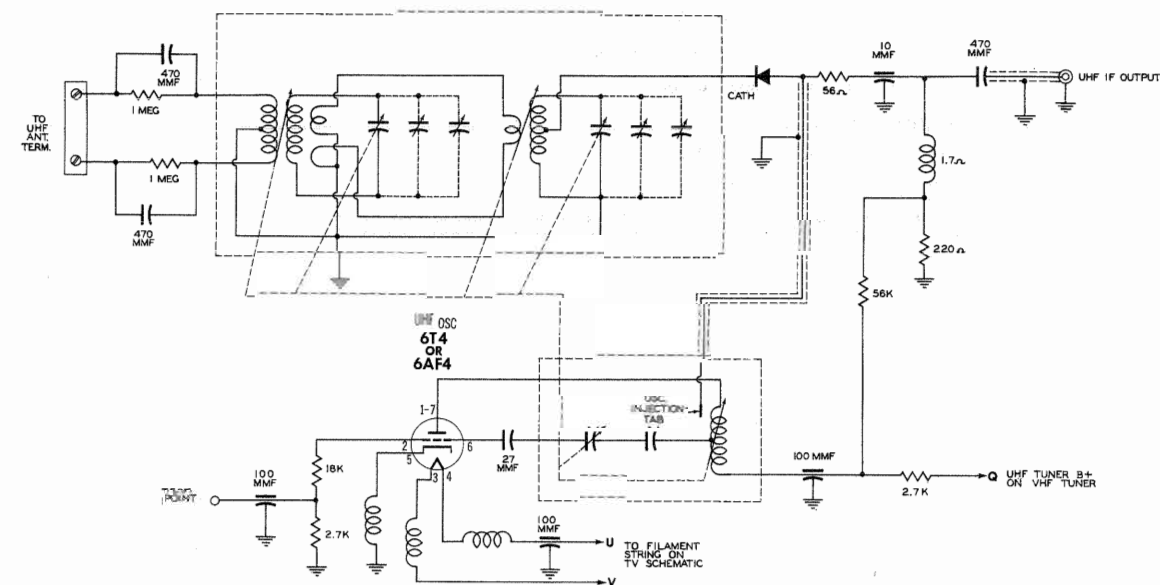
HIGH VOLTAGE

<p><u>LOSS OF HIGH VOLTAGE</u></p> <p>Check by substitution V10, V13, V14, V15 and V16. Check waveform W14.</p>		<p><u>INSUFFICIENT HIGH VOLTAGE</u></p> <p>Check by substitution V10, V14 and V15. Check M1 and M2. Check R95, R91, C1, C86, C85, T2 and other associated components.</p>	
<p>If Satisfactory</p>	<p>If Unsatisfactory</p>	<p><u>BLOOMING</u></p> <p>Check by substitution V10, V14, V15 and V16. Check C1, C85, C86, R91, R89, R95, R94 and other associated components.</p>	
<p>Check T2, T4A, C88, R91 and other associated components.</p>	<p>Check L39, C82, C83, C84, C86, R84, R85, R87, R88 and other associated components.</p>		

GENERAL

<p><u>RASTER, SOUND, NO PICTURE</u></p> <p>Follow procedure outlined under "Loss of Video."</p> <p><u>RASTER, PICTURE, NO SOUND</u></p> <p>Follow procedure outlined under "Weak or no Sound."</p> <p><u>RASTER, NO SOUND, NO PICTURE</u></p> <p>Check by substitution V1, V2, V3, V4, V5, V6 and V10. Check video IF components for failure or change of value.</p>	<p><u>NO RASTER, NO SOUND</u></p> <p>Follow procedure outlined under "Dead Set."</p> <p><u>KEYSTONE EFFECT</u></p> <p>Check T4 and its associated components.</p> <p><u>INTERMITTENT STREAKS</u></p> <p>Check high voltage section for corona discharge and arcing.</p>
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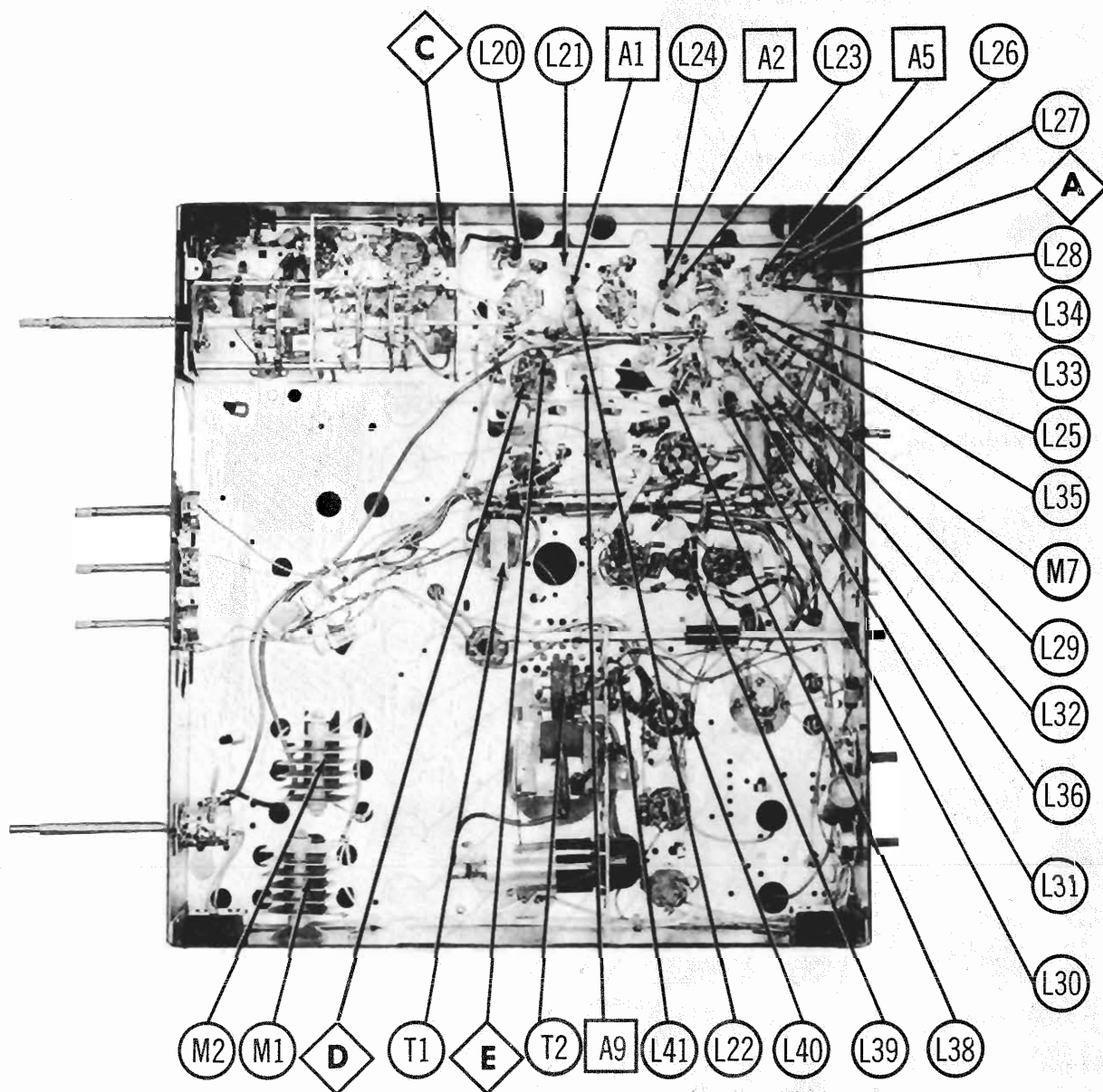
Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.



UHF TUNER WTT37 USED ON CHASSIS. TS 531Y AND WTS 531Y
A PHOTOFACIT STANDARD NOTATION SCHEMATIC
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UHF TUNER SCHEMATIC

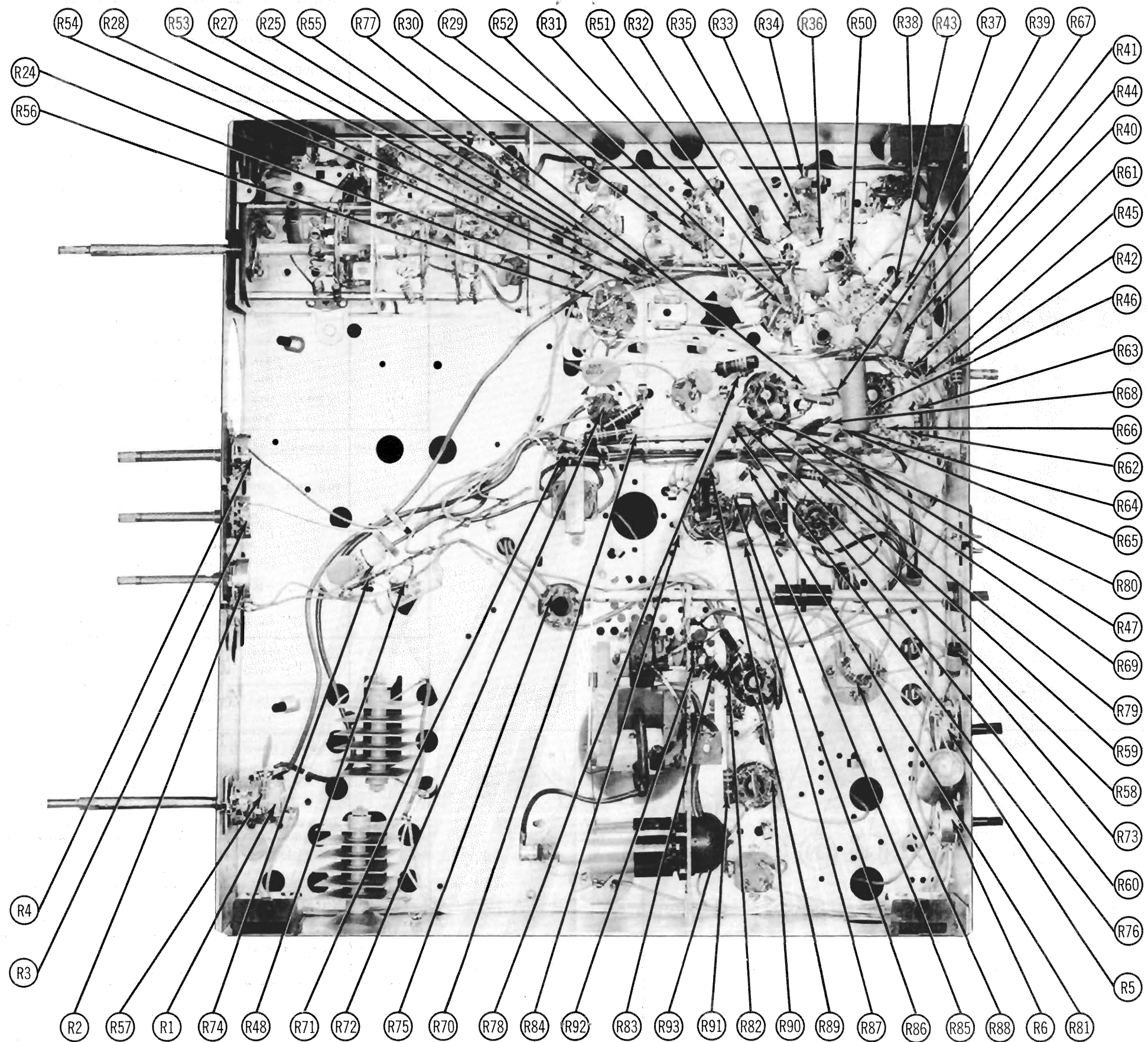
**MOTOROLA MODELS 21K29, B, W, Y21K29, B, W,
21K30, B, Y21K30, B, 21T21, B, E, Y21T21, B, E,
21T22, B, Y21T22, B (Ch. TS-531, Y, WTS-531, Y)**



CHASSIS BOTTOM VIEW-TRANS., INDUCTOR AND ALIGNMENT IDENTIFICATION

PRODUCTION CHANGES	
	The following production changes were made during production. Whenever possible the reason for the change is also given.
Ch. TS-531	<p><u>COMPONENT CHANGE</u></p> <p>R9, 820Ω resistor, added from the junction of C15 and C16 to ground.</p>
Ch. TS-531A-01	<p><u>TO REDUCE REGENERATION</u></p> <p>C37 and L20 are removed from the junction of R25 and R26.</p> <p>R29 is decreased from 47KΩ to 15KΩ.</p> <p>R25 is decreased from 22KΩ to 15KΩ.</p>
Ch. TS-531A-02	<p><u>TO REDUCE REGENERATION</u></p> <p>R28 is omitted.</p> <p>C38 is connected from R25 to ground.</p>
Ch. TS-531A-03	<p><u>TO LIMIT BRIGHTNESS LEVEL</u></p> <p>R47 is omitted.</p> <p>C53 is omitted.</p> <p>R46 is increased from 100KΩ to 220KΩ.</p> <p>R49 is decreased from 220KΩ to 100KΩ.</p> <p>R49 is removed from ground and connected to the 145V line.</p> <p>Pin 8 of deflection yoke (T4) is removed from 245V line and connected to boost, 490V.</p> <p><u>TO PREVENT ARCING AT MAXIMUM AUDIO LEVEL</u></p> <p>A 100Ω resistor added from pin 3 of V10 to blue lead of T5.</p>
Ch. TS-531A-04	<p><u>TO ELIMINATE AUDIO OSCILLATION</u></p> <p>C55 is replaced by two single 1000MMF capacitors.</p> <p><u>TO INCREASE HORIZONTAL SIZE</u></p> <p>R89 is increased from 4.7KΩ to 6.8KΩ.</p> <p>R91 is increased from 330Ω to 5.6KΩ.</p> <p>A .1MFD capacitor added from pin 4 of V14 to ground.</p> <p>R58 is increased from 1.5KΩ to 1.8KΩ.</p> <p>C59 is omitted.</p> <p>R51 is connected to ground.</p> <p>The suppressor grid (pin 2 of V7) is connected directly to ground.</p>
Ch. TS-531A-05	<p><u>COMPONENT CHANGE</u></p> <p>L30 is changed. C51 shunting L30 is decreased from 30MMF to 27MMF.</p>
Ch. TS-531A-06	<p><u>TO REDUCE TRAILING WHITES</u></p> <p>L33, shunt peaking coil, wound on 1KΩ resistor. New part #24K736496.</p>
Ch. TS-531A-07	<p><u>TO IMPROVE SENSITIVITY</u></p> <p>R9 is omitted.</p> <p>C15 is decreased from 3MMF to 1.5MMF.</p> <p>A 2.2MMF capacitor added from pin 1 of V2 to ground. With these changes the tuner is changed to part #TT-72A.</p>
Ch. TS-531A-08	<p><u>TO REDUCE REGENERATION</u></p> <p>C98 is added from pin 1 of V17 to ground.</p>
Ch. TS-531A-09	<p><u>COMPONENT CHANGE</u></p> <p>Horizontal output transformer (T2) is changed to part #24K736082.</p>
Ch. TS-531A-10	<p><u>COMPONENT CHANGE</u></p> <p>L35 changed to part #24K736228.</p>

MOTOROLA MODELS 21K29, B, W, Y21K29, B, W, 21K30, B, Y21K30, B, 21T21, B, E, Y21T21, B, E, 21T22, B, Y21T22, B (Ch. TS-531, Y, WTS-531, Y)



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

MOTOROLA MODELS 21K29, B, W, Y21K29, B, W, 21K30, B,
Y21K30, B, 21T21, B, E, Y21T21, B, E, 21T22, B, Y21T22, B
(Ch. 1S-531, Y, WTS-531, Y)

PARTS LIST AND DESCRIPTIONS (Continued)

MISCELLANEOUS

ITEM No.	PART NAME	MOTOROLA PART No.	NOTES
M4	Tuner	1U735114	VHF - Chassis TS-531, WTS-531
M5	Tuner	1U735118	VHF - Chassis TS-531Y, WTS-531Y
M6	Video Det. Assy.	VT-37	UHF - Chassis TS-531Y, WTS-531Y
M7	Switch	24C735329	Includes M3, coils and capacitors
M8	Centering Device	48A721145	Area Selector
	Centering Device	48A733487	Includes deflection yoke rear cover - For all deflection yokes, except yoke part #24C733436
			Includes deflection yoke rear cover - For yoke part #24C733436 only
M9	Ion Trap	59K734028	Models 21K29, Y21K29
	Cabinet	16K735156	Models 21K29B, Y21K29B
	Cabinet	16K735157	Models 21K29W, Y21K29W
	Cabinet	16K735598	Models 21K30, Y21K30
	Cabinet	16F735158	Models 21K30B, Y21K30B
	Cabinet	16K735159	Models 21T21B, Y21T21B
	Cabinet	16K735332	Models 21T21E, Y21T21E
	Cabinet	16K735333	Models 21T22, Y21T22
	Cabinet	16E735161	Models 21T22B, Y21T22B
	Cabinet	16K735162	Models 21K30W, Y21K30W
	Cabinet	16K735966	Models 21K33E, Y21K33E
	Knob	16F736034	VHF channel selector - Models 21K29, 21K29B, 21K29W, 21K30, 21K30B, 21T21B, 21T22, 21T22B
	Knob	36K735381	VHF Channel selector - Models 21T21E, 21K33E
	Knob	36K735383	VHF channel selector - Models Y21K29, Y21K29B, Y21K29W, Y21K30, Y21K30B, Y21T21B, Y21T22, Y21T22B
	Knob	36C735380	VHF channel selector - Models Y21T21E, Y21K33E
	Knob	36K735382	Fine tuning & on-off-volume - Models 21K29, 21K29B, 21K29W, Y21K29, Y21K29B, Y21K29W, 21K30, 21K30B, Y21K30, Y21K30B, 21T21B, Y21T21B, 21T22, 21T22B, Y21T22, Y21T22B
	Knob	36C735384	Fine tuning & on-off-volume - Models 21T21E, Y21T21E
	Knob	36K735385	Y21K33E, Y21K33E
	Knob	36C735378	Contrast - Models 21K29, 21K29B, 21K29W, Y21K29, Y21K29B, Y21K29W, 21K30, 21K30B, Y21K30, Y21K30B, 21T21B, Y21T21B, 21T22, 21T22B, Y21T22, Y21T22B
	Knob	36K735379	Contrast - Models 21T21E, Y21T21E, 21K33E, Y21K33E
	Knob	36B712294	Area Selector Switch - All models
	Knob	36B733492	Horiz., Vert. & Brightness - Models 21K29, 21K29B, 21K29W, Y21K29, Y21K29B, Y21K29W, 21K30, 21K30B, Y21K30, Y21K30B, 21T21B, Y21T21B, 21T22, 21T22B, Y21T22, Y21T22B
	Knob	36K735294	Horiz., Vert. & Brightness - Models 21T21E, Y21T21E
	Scale	34C735386	UHF channel selector - Models Y21K29, Y21K29B, Y21K29W, Y21K30, Y21K30B, Y21T21B, Y21T21E, Y21T22, Y21T22B
	Safety Glass	61K732778	Models 21K29, 21K29B, 21K29W, Y21K29, Y21K29B, Y21K29W
	Safety Glass	61K734345	Models 21K30, 21K30B, Y21K30, Y21K30B, 21T22, 21T22B, Y21T22, Y21T22B
	Safety Glass	61K733388	Models 21T21B, 21T21E, Y21T21B, Y21T21E
	Mask	13D735047	All models

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		MOTOROLA PART No.	STANDARD REPLACEMENT		
V1	RF Amp.	4BQ7A	4BQ7A	9A7	
V2	Mixer-Osc.	5U8	5U8	9AE	
V3	1st Video IF Amp.	6CB6	6CB6	7CM	
V4	2nd Video IF Amp.	6CB6	6CB6	7CM	
V5	3rd Video IF Amp.	6CB6	6CB6	7CM	
V6	Video Output	12BY7	12BY7	9BF	
V7	Sound IF Amp.	3AU6	3AU6	7BK	
V8	Ratio Det.	6AL5	6AL5	8BT	
V9	AF Amp. - Horiz. AFC	6SN7GT	6SN7GT	8BD	
V10	Audio Output	25L6GT	25L6GT	7S	
V11	Sync Sep. - Sync Amp.	12SN7GT	12SN7GT	8BD	
V12	Vert. Osc. - Vert. Output	12BH7	12BH7	9A	
V13	Horiz. Mult.	6SN7GT	6SN7GT	8BD	
V14	Horiz. Output	25BQ6GTB	25BQ6GTB	6AM	25CU6 used as alternate.
V15	Damper	12AX4GT	12AX4GT	4CG	
V16	HV Rect.	1B3GT	1B3GT	2C	

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA					RETMA BASE TYPE	NOTES
	MOTOROLA PART No.	CBS PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	WESTINGHOUSE PART No.		
V17	21AUP4 21AUP4A ①	21AUP4A ①		21AUP4 21AUP4A ②	21AUP4 21AUP4A ①	12L 12L	① Aluminized ② Silver screen

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	MOTOROLA PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	
C1	140	150	23B484097	FPI17	TM-140-150	T-055	
C2A	100	300	23B731620		TM-3136	Q-162	
B	200	150				MT-1520	
C	60	150					
C3A	200	150	23B710941	FP216.1	TM-2029	D-088	
B	5	150					
C4A	10	50	23B730205	FP330.5	TM-T10-300	T-095	
B	10	50					
C	10	300					
C5	2	10	23A733205	TC302	TD-2-25	MMT-0505	
C6	10	450	23A702450	TC72	TD-10-450	FM-4510	

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	MOTOROLA PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	
C7	470	2000	21R121478	DD30-471	3KV-471	DC30347	
C8	470	2000	21R121478	DD30-471	3KV-471	DC30347	
C9	150		21R121228	TCN-150	N750-337-151		
C10	6.8		21R120561				
C11	3.3		21R115951	TCZ-3R3	NPOA-3R3	ZT-5533	
C12	470		21R114554	D8-471	GP2K-471	UC-5347	
C13	220		21R410115	DD-221	811-221	UC-5322	
C14	10000		21R482726	DD-103	811-01	DC-511	
C15	3		21R115951	TCZ-3R3	NPOA-030	ZT-553	
C16	8.2		21R122084				
C17	1000		21R120672	MFT-1000			
C18	5-3		21K710943	829-3	3115-01-0R5	CT565A	
C19	1500		21R120100	DD-152	801-0015	DC-5215	
C20A	800		21R400493	DD2-102	812-001	DCD-521	
B	800						
C21	1500		21R120100	DD-152	801-0015	DC-5215	
C22A	1500		21R121406	DD2-152	812-0015	DCD-5215	
B	1500						
C23	10		21R121114	DD-100	831-100	UC-541	
C24	1		21R114071	TCZ-1	NPOA-010		
C25	5-3		21K710943	829-3	3115-01-0R5	CT565A	
C26	12		21R119132				
C27	2.2			TCZ-2R2	NPOA-2R2		
C28	1500		21R120100	DD-152	801-0015	DC-5215	
C29	10000		21R482726	DD-103	811-01	DC-511	
C30A	800		21R400943	DD2-102	812-001	DCD-521	
B	800						
C31	1000		21R115388	DD-102	801-001	DC-521	
C32	470		21R115856	DD-471	831-471	UC-5347	
C33	10000		21R482726	DD-103	811-01	DC-511	
C34	1500		21R120100	DD-152	801-0015	DC-5215	
C35	1500		21R120100	DD-152	801-0015	DC-5215	
C36	1500		21R120100	DD-152	801-0015	DC-5215	
C37	100		21R410036	TCN-100	N750L-101	NT-531	
C38	470		21R410121	DD-471	831-471	UC-5347	
C39	560		21R120936	DD-561	811-561	UC-5356	
C40	50		21R114207	TCN-50	N750K-500	NT-5447	
C41	1000		21R115388	DD-102	801-001	DC-521	
C42	560		21R120936	DD-561	811-561	UC-5356	
C43	1500		21R120100	DD-152	801-0015	DC-5215	
C44	39		21R121468	TCN-39	N750K-390		
C45	1000		21R410127	DD-102	801-001	DD-102	
C46	22		21R120539				
C47	22		21R120539				
C48	470	200	21K121797	DD-471	831-471	UC-5347	
C49	.1		6R121573	DF-104		PT401	
C50	5000		21R115312	DD-502	811-005	DC-525	
C51	30		21R410048				

Note 7

MOTOROLA MODELS 21K29, B, W, Y21K29, B, W, 21K30, B, Y21K30, B, 21T21, B, E, Y21T21, B, E, 21T22, B, Y21T22, B, (Ch. TS-531, Y, WTS-531, Y)

CAPACITORS (cont)

ITEM No.	RATING		REPLACEMENT DATA				NOTES
	CAP.	VOLT.	MOTOROLA PART No.	CENTRALAB PART No.	ERIE PART No.	MALLORY PART No.	
C52	.1	200	8R121573	DF-104		PT401	
C53	10000			DD-103	811-01	DC-511	Note 1
C54	18		21R120578	D6-180	831-180	UC-5418	
C55A	4700	}	21R121489	DD2-502	811-0047	DC-525	Note 5
B	4700				811-0047	DC-525	Note 5
C56	5000			21R115312	DD-502	811-005	DC-525
C57	5000		21R115312	DD-502	811-005	DC-525	
C58	470		21R114554	DD-471	831-471	UC-5347	
C59	1000		21A121678	DD-102	801-001	DC-521	
C60	.005	100	21R115312	D6-502	GP2-333-502	PT625	
C61	3300		21R120422	D6-332	GP2-333-332	UC-5233	
C62	5000		21R115312	DD-502	811-005	DC-525	
C63	.01	400	8R121002	D6-103	GP2-333-103	PT411	
C64	.02	600	8R122079	DF-203	817-02	PT612	
C65	10000		21R482726	DD-103	811-01	DC-511	
C66	4700		21R120149	DD-472	811-0047	DC-525	
C67	220		21R115905	D6-221	GP2K-221	UC-5322	
C68	.05	400	8R121567	DF-503	PT415	PT415	
C69	.0047	400	8K734634	D6-472	GP2-333-472	PT6247	
C70	.0047	400	8K734634	D6-472	GP2-333-472	PT6247	
C71	.01	400	8K734633	D6-103	GP2-333-103	PT411	
C72	4700		21R120149	DD-472	811-0047	DC-525	
C73	.05	400	8K490232	DF-503	PT415	PT415	
C74	.05	400	8K490232	DF-503	PT415	PT415	
C75	5000	2000	21R120093				
C76	470		21R114554	DD-471	831-471	UC-5347	
C77	1000		21R118749	D6-102	GP2L-102	UC-521	
C78	.001	1000	8K479268	DD-102	IR5KV-102	PT621	
C79	.0033	600	8R121569	D6-332	GP2-333-332	PT6233	
C80	1000		21R115388	DD-102	801-001	DC-521	
C81	.01	400	8R121002	D6-103	GP2-333-103	PT411	
C82	100		21R115900	D6-101	GP1K-101	UC-531	
C83	.0047	400	8K734634	D6-472	GP2-333-472	PT6247	
C84	390		21B735757	D6-391	811-391	MCB243	
C85	390		21B735757	D6-391	811-391	MCB243	
C86	5000		21R115312	DD-502	811-005	DC-525	
C87	.1	400		DF-104		PT401	
C88	100	3000	21R121424	DD30-101	3KV-101	DC3031	
C89	39	2000	21R122121	DD30-390			Note 6
C90	5000	2000	21R120093				
C91A	800	}	21R400943	DD2-102	812-001	DCD-521	Note 2
B	800						Note 2
C92	1500			21R120100	DD-152	801-0015	DC-5215
C93	470		21R114554	DD-471	831-471	UC-5347	
C94A	470	}	21R121688	DD-471	831-471	UC-5347	
B	470			DD-471	831-471	UC-5347	
C95	1000			21R115388	DD-102	801-001	DC-521
C96	5000		21R115312	DD-502	811-005	DC-525	
C97	5000	2000	21R120093				
C98	5000		21R115312	DD-502	811-005	DC-525	Note 8
C99	10000			DD-103	811-01	DC-511	Note 3

Note 1. Not used in chassis 531A-03. (Some versions use 5000MMF in this application (part #21R115312).

Note 2. Some versions use 470MMF in this application (Part #21R121688).

Note 3. Not used in some versions.

Note 4. Not used in chassis 531A-04 and later.

Note 5. In chassis 531A-04 and later C58A and C58B are single 10000MMF units.

Note 6. Used only in chassis 531A-04 and later.

Note 7. Chassis 531A-05 use 27MMF in this application.

Note 8. Not used prior to chassis 531A-08.

Note 9. Chassis 531A-07 uses 1.5MMF in this application.

Note 10. Not used prior to chassis 531A-07.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	MOTOROLA PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
RIA	1500Ω	1/2	18B730149	QJ-510	RTV-461	FI-7	UE198S††	Contrast Volume Tapped at 300KΩ. Attach to RIA. Attach to RIB. Brightness Att. to R2A. Horizontal Hold Attach to R3A. Vertical Hold stop at 500KΩ. Attach to R4A. Vertical Linearity Attach to R5A. Vertical Bias stop at 5Meg Attach to R6A.
B	1Meg	1/2				R2-59		
C	Switch					KB-1	U-87	
R2A	5Meg	1/2	18B734142	Q11-141	A47-5Meg-S	AB-87	Not Req.	
R3A	5Meg	1/2	Not Req.	Not Req.	KSS-3	AB-40	Not Req.	
R4A	100KΩ	1/2	18B734145	Q11-126	A47-100K-S	AK-4	Not Req.	
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	
R4A	850KΩ	1/2	18K734143	Q11-133	A47-500K-S	AB-59	U-50	
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	
R5A	750Ω	1/2	18K733414	Q11-105	A47-750-S	AB-5	TAP751L	
B	Shaft		Not Req.	Not Req.	RN-3	AK-19	Not Req.	
R6A	6Meg	1/2	18B733413	Q11-141†	A47-5Meg-S†	AB-87†	SU-87†	
B	Shaft		Not Req.	Not Req.	RN-3	AK-19	Not Req.	

† Connect a 350KΩ Resistor in series with the right hand terminal of the control and the lead connecting to the same terminal of the original control (control viewed from the shaft end, terminals down).

† Connect a 1Meg. resistor in series with the right hand terminal of the control and the lead connecting to the same terminal of the original control (control viewed from the shaft end, terminals down).

‡ CONCENTRIK™ EQUIVALENT: K-4 KIT, BASE ELEMENTS AND SHAFTS, B17-109, P10-308 (Panel)

B13-137X, R13-331 (Rear)

78-1 Switch

†† Use Mallory #203 and #212 insulating washers to insulate control from chassis.

RESISTORS

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	MOTOROLA PART No.	IRC PART No.	
R7	1Meg	1/2	6R8004	BTS-1Meg	
R8	1Meg	1/2	6R8004	BTS-1Meg	
R9	820Ω	1/2			
R10	22KΩ	1/2	6R6397		
R11	47KΩ	1/2	6R6058		
R12	10KΩ	1/2	6R6054		
R13	10Ω	1/2	6R5621		
R14	3300Ω	1/2	6R6036		
R15	470Ω	1/2	6R3949		
R16	10KΩ	1/2	6R6054		
R17	4700Ω	1/2	6R6039		
R18	220KΩ	1/2	6R6015		
R19	4700Ω	1/2	6R6039		
R20	10KΩ	1/2	6R6054		
R21	15KΩ	1/2	6R6477		

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS (cont)

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	MOTOROLA PART No.	IRC PART No.	
R37	4700Ω	1/2	6R8080		
R38	180KΩ	1/2	6R6444		
R39	1Meg	1/2	6R8046		
R40	180KΩ	1/2	6R6444		
R41	5600Ω	1/2	6R8117		
R42	18KΩ	1/2	6R5734		
R43	22KΩ	1/2	6R2098		
R44	3900Ω	1/2	17K734046	PW7-3900	
R45	12KΩ	1/2	6R6394		
R46	220KΩ	1/2			
R47	100KΩ	1/2			
R48	2.2Meg	1/2	6R3927		
R49	220KΩ	1/2	6R6407		
R50	2200Ω	1/2	6R8069	BTS-2200	
R51	150Ω	1/2	6R6373	BTS-150	
R52	220Ω	1/2	6R8270	BTS-220	
R53	220Ω	1/2	6R8270	BTS-220	
R54	220Ω	1/2	6R8270	BTS-220	
R55	33KΩ	1/2	6R6410	BTS-33K	
R56	22KΩ	1/2	6R6397	BTS-22K	
R57	68KΩ	1/2	6R8001	BTS-68K	
R58	1500Ω 5%	1/2	6R400459	BTS-1500 5%	
R59	33KΩ 5%	1/2	6R5758	BTA-33K 5%	
R60	100Ω	1/2		BTS-100	
R61	3.3Meg	1/2	6R6497		
R62	1.5Meg	1/2	6R3996		
R63	270KΩ	1/2	6R6414		
R64	1Meg	1/2	6R8046		
R65	560KΩ	1/2	6R5697		
R66	22KΩ	1/2	6R6397		
R67	2200Ω	1/2	6R8069		

Note 1. In initial production R25 was 22K and R29 was 47K.

Note 2. Used in production runs before TS-531A-02.

Note 3. Production runs before TS-531A-03 use a 100KΩ resistor in this application.

Note 4. Production runs before TS-531A-03 use a 470KΩ resistor in this application.

Note 5. Not used in production runs TS-531A-03 and later.

Note 6. Used in production runs TS-531A-03 and later.

Note 7. Production runs TS-531A-04. R89 is 6800Ω and R91 is 5600Ω.

Note 8. Production run TS-531A-04. R58 is 1800Ω.

Note 9. Not used in some versions.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	REPLACEMENT DATA							
		MOTOROLA PART No.	Hallidorsen PART No.	Merit PART No.	RCA TYPE No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	Vert. Osc. Trans.	25B730179	B8702	A-3006	V405	A-8125	26A03	A-97X	
T2	Horiz. Output Trans.	24K735644①		HVO-39*	X118 *	A-8248 *	FLY-57 *		
		24K738082②							
		③ ④							
T3	Vert. Output Trans.	25B731015	Z1805③④	A-3081	V306③④	A-8140④	26S57③④	A-110X④	
		25K721027②							
T4A	Yoke-Horiz. (24.5MH)	24K732711②	DF603②	MDP-74	214D1	Y70F25/3	DY-10A	Y-20-1②	
		③ ④	③ ④	③ ④	③ ④	③ ④	③ ④	③ ④	
		⑤ ⑥							
		⑦ ⑧							
		⑨ ⑩							
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① Complete assembly. Includes the following items which may be purchased separately: V16, HV Rectifier, primary coil, Motorola part #24K735600, secondary coil (Motorola part #24K731990).

② Alternate vertical output transformer.

③ Drill new mounting hole(s).

④ Connect as auto transformer.

⑤ Use 50 to 1 turns ratio.

⑥ Includes plug (Motorola part #28A732677). Does not include rear cover and centering device (Motorola part #4